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ABSTRACT

The study investigated the listening ability of 13 visually impaired college students. Ss were pretested on a listening skills test and then exposed to each of three modes of speech presentation (normal speech, accelerated speech, and compressed speech) in a counterbalance order. It was postulated that a differential effect in performance would result from the three speech presentation modes, with both the accelerated and compressed speech modes being superior in comparison with the normal mode. Results showed a consistent and significant trend toward better performance on the accelerated over the normal mode, and on the compressed over both the accelerated and normal modes. Findings suggested that human sensory and perceptual systems are capable of enhanced and accelerated information processing functions, and that the brain and nervous system may operate in a standard manner much of the time, but it is able to deal with incoming information in a more sophisticated and efficient way when necessary. (Author/SB)

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Listening Comprehension of Compressed, Accelerated and Normal Speech By the Visually Handicapped

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An investigation of listening ability in 13 visually impaired college student was conducted. Subjects were pretested on a listening skills test and then exposed to each of three modes of speech presentation (normal speech, accelerated speech, and compressed speech) in a counterbalance order. Results showed a consistent and significant trends towards better performance on the accelerated over the normal mode, and on the compressed over both the accelerated and normal modes.

A humanitarian, democratic society attempts to incorporate all of it's members into socially productive and personally beneficial lifestyles. Of the various disadvantaged groups, those with sensory and perceptual impairments are of special interest and a challenge to the educational system. This is so not only because these individuals must struggle to overcome their handicap, but also because they pose certain special problems of instruction for the educator. An extensive and growing body of literature concerning the blind and visually handicapped student testifies to the increasing needs of such people for improvements in both technological and instructional areas to assist them in obtaining a quality education. A major role for such development has been assigned to the development of better listening skills for the visually impaired, since this is a primary mode of acquiring academic information (Bischoff, 1979; Gore, 1970).

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Books and related publications treating the general topic of teaching listening skills are available (e.g., Anderson, 1949; Carpenter, 1965; Duker, 1971; Lundsteen, 1964), as are articles dealing with testing and measurement procedures for implementing such training techniques in research settings (e.g., Garvey, 1953; Goldstein, 1940).

The purpose of this report is not to make an exhaustive, nor even a comprehensive survey and analysis of the available literature, but to present the findings of an exploratory experimental study of the comparison of three different modes of recorded speech presentation to a group of visually impaired college students. This investigation was undertaken as an attempt to replicate and possibly extend previous findings of other investigators (Gore, 1969; Nolan & Morris, 1969). This project is of additional interest in view of experimental data which supports the position that information stored in short-term memory is of an acoustic type, regardless of whether the initial scource of the information was auditory or visual, and further, that long-term information storage is semantic and an extraction of the meaning of the short-term acoustic storage (Wickelgren, 1965). More specifically, then, it is postulated that a differential effect in performance will result from the three speech presentation modes, with both the accelerated and compressed speech modes being superior in comparison with the normal mode.

Method

Subjects:

Subjects were 13 college students attending Weber State College (11 males and 2 females), and ranged in age from 18 to 58 years old (median age = 32.6).

Of the participants, 5 were classifed as totally blind, and 3 were able to read large print. All subjects were experienced in braille, and all were earning a grade point average of letter grade C or higher, at the time of the experiment. Subjects reported no auditory impairments or related hearing difficulties. All subjects were paid at the rate of $2.00 per hour for their participation, although, all stated they would gladly participate on a volunteer basis because of inherent interest in the study.

Procedures:

The experimental environment was a large room (14 x 18 ft.) of the Social Science Building originally designed and utilized as a child development study area, and was thus isolated from the classrooms on the same floor. This provided a constant testing environment throughout the study.

Upon entering the experimental room, each subject was seated in a comfortable, upright armshair and asked to complete a personal history form and was then briefed as to the procedures to follow. Those procedures then included a pretest of tape recorded material (Form AM, Parts A and B of the Brown-Carlsen Listening Comprehension Test -- Brown & Carlsen, 1955), presented at normal conversational rate (180 words per minute). This consisted of a series of brief statement and question items to which the subject made immediate response (immediate recall pretests). Next, the subject was pretested on a "lecture comprehension" component of the Brown-Carlsen test (Form AM, Part E), which consisted of a taped passage to which the subject answered questions after listening to the entire passage. Each pretest took approximately 20-minutes to complete, and percent correct responses were recorded for each. After the pretests, the subject was given a 10-minute rest

break, and then listened to one of the three experimental listening modes, i.e., either the normal speech mode (Norm), the accelerated mode (Accl. of 270 wpm), or the compressed mode (Comp. to 60% normal). The acceleration tape was at a rate 30% faster than normal. Material for the three speech modes was obtained from a standard text used to develop reading skills (Bilbert, 1956). All material was taped by a standard female reader to control voice characteristics, intonation, etc. At the end of each listening session, a response measure of percent correct responses to a series of questions was recorded for later data analysis.

Each subject completed all parts of the experimental procedure on the first day of participation, and returned a second day to complete a second speech listening and testing session, and again on a third day for the listening and test on the third mode. Each day required 1½ to 2 hours of time. After completing the entire sequence of the three speech modes, each subject was given a post-experimental test on another equivalent norm of the Brown-Carlsen Listening Comprehension Test (Form BM, Parts A and B, and Form BM, Part E). These respective posttests corresponded to the immediate recall and were used as a pre-experimental vs. post-experimental comparison for a learning effect which may have taken place due to exposure of the experimental speech made material.

Experimental Design:

A counterbalanced design was employed, with each subject being exposed to and tested on each of the three listening speech modes. Since there were three modes, there were six possible sequences, or orders of mode presentation, and since there were 13 subjects, each order of presentation was used at least twice

for complete counterbalancing. This counterbalancing technique is assumed to control extraneous confounding variables by distributing them across the subjects in the differential orders of mode presentation.

Proposed data analysis included a menas comparison test on the pre-tests, the post-tests, the pre- vs. post-tests, and among the three speech presentation modes, e.g., between the normal vs. accelerated, normal vs. compressed, and accelerated bs. compressed.

Each subject was given a post-experimental interview to review the procedures and tentative findings, and to answer any questions the subject might have.

Results

The descriptive statistics for pre- vs. post-test comparisons, speech presentation modes, an age analysis, and an age by speech presentation mode analysis are presented in Table I.

Insert Table I About Here

Pre-test vs. post-test means were compared using the A-test, which is a simplified statistical test analogous to Student's T-test for correlated samples (Sandler, 1955; Zanhausern, 1967). Neither the pre- vs. post-test comparison for the immediate recall, nor for the lecture comprehension tests were statistically significant ($p = .05$), although there was a slight trend towards improved scores on post-test compared with the pre-test for both of these measures (ref. Table I).

For the speech presentation mode analysis, the difference between the normal and the accelerated conditions was significant ($p = .01$), as was the mean difference between the normal and the compressed modes ($p = .001$), and the difference between the accelerated vs. the compressed treatments ($p = .01$). There was also a consistent trend towards greater and greater improvement in terms of the response measure (percent correct answers to test questions), with poorest performance being made on the normal mode, second best performance on the accelerated mode and best performance on the compressed mode (ref. Figrue 1).

Analysis of the age groups data, where the subjects under 30-years of age (Under 30) vs. those 30-years of age and older (30+) showed no statistical difference. Neither did the analysis of the age of speech presentation mode data show any significant differences between any of the group comparisons, e.g., the under 30 normal vs. 30+ normal, under 30 accelerated vs. 30+ accelerated, and the under 30 compressed vs. 30+ compressed. There was, however, the same consistent trend towards improvement from the normal to the accelerated to the compressed mode conditions evident in this data and for that reason that data is presented in Fig. 2 for visual inspection.

Insert Fig. 1 About Here

Discussion & Conclusions:

The results of this study support the initial hypothesis that a significant differential effect upon subjects' performance would be found between the three

speech presentation modes. The significant and consistent trend towards improved listening and comprehension scores beginning with the normal presentation rate of 180 wpm, and progressing systematically through the accelerated rate of 270 wpm, with the most superior performance on the compressed speech mode indicates the value of not only training visually impaired persons on listening comprehension skills, but that certain modes of speech presentation are more valuable than others for such training.

Such findings are consistent with the previous findings of Foulke (1971) who has shown that speech comprehension and processing at a rate of about 175 wpm is not uncommon for blind students in grades 6 through 8, and that such students can handle rates of 275 wpm of tape recorded speech with little or no special training. Foulke has also indicated that more mature and experienced blind and visually impaired students are able to comprehend rates of up to 300 or more wpm, and suggests that a 25% compression level may be most suitable for most blind listerners. This latter suggestion has not been substantially verified by experimental evidence, however, and requires test and substantiation. Furthermore, one may only speculate at this time as to the superiority of the compressed over both the accelerated and normal modes of speech presentation. It is evident from a large body of sensory and perceptual literature that the psychophysical limits for information-processing of sensory modalities, e.g., sight, hearing, touch, etc., are certainly beyond that of the normal (i.e., average) rates of most individuals. This suggests that human sensory and perceptual systems are capable of enhanced and accelerated information-processing functions, and that the brain and nervous system may operate in a standard

manner much of the time, but that it is able to deal with incoming information in a more sophisticated and efficient way when necessary. That is, the capability of the system can be extended beyond normal or standard levels in terms of complexity, rate, integration and related characteristics of information processing. This is most probably the result of the inherent design and intrinsic operational characteristics of the nervous system itself. In other words, we simply do not usually exceed the operational features of our sensory or perceptual systems under normal environmental situations. Laboratory evidence offered in experimentally based texts, as well as the evidence of speical training programs oriented at exploring and extending normal sensory-perceptual functions supports such a conclusion. Exactly why the compressed mode proved superior to the accelerated mode of speech is at this poitn a mystery, although the answer may be found in an examination of how the nervous system codes and processes such information. This study was not designed to make such an investigation, however.

It was interesting that the older subjects, i.e., those in the 30+ group, performed generally better than those in the under 30 group. While such differences were not statistically significant, they did reveal again the trend towards improved performance from the normal to the accelerated to the compressed mdoe, and further suggest that older, and perhaps more experienced subjects may benefit from their previous experience at a somewhat different manner than those with less experience. This conclusion must be systematically explored in an experimental fashion, however, as should the effects of more prolonged listening skills training in each of the modes utilized. It is also of importance to replicate and extend such findings with those persons who are not visually impaired since all students could potentially profit from listening and comprehension skills training.

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Table I: Descriptive Statistics

Pre-test & Post-test Data:

Pre-test (immediate recall)	Post-test (immediate recall)
X = 68.30	X = 73.20
Pre-test (lecture comprehension)	**Post-test (lecture comprehension**
X = 64.00	X = 65.90

Speech Presentation Mode Data:

	Normal (n = 13)	Accelerated (n = 13)	Compressed (n = 13)
X	64.00	75.40	85.10
SD	7.88	6.83	5.00
S	62.09	46.65	28.01

Age Analysis Data:

	Under 30 (n = 6)	30+ (n = 7)
X	69.33	79.57
SD	16.75	8.34
S	280.67	69.62

Age by Speech Presentation Mode Data:

Under 30:	Normal	Accelerated	Compressed
X	58.67	68.83	79.83
SD	20.34	17.15	16.00
S	413.87	294.17	256.17
30+:			
X	68.71	80.14	89.57
SD	15.90	9.75	3.25
S	252.90	95.14	10.62

Figures 1 & 2

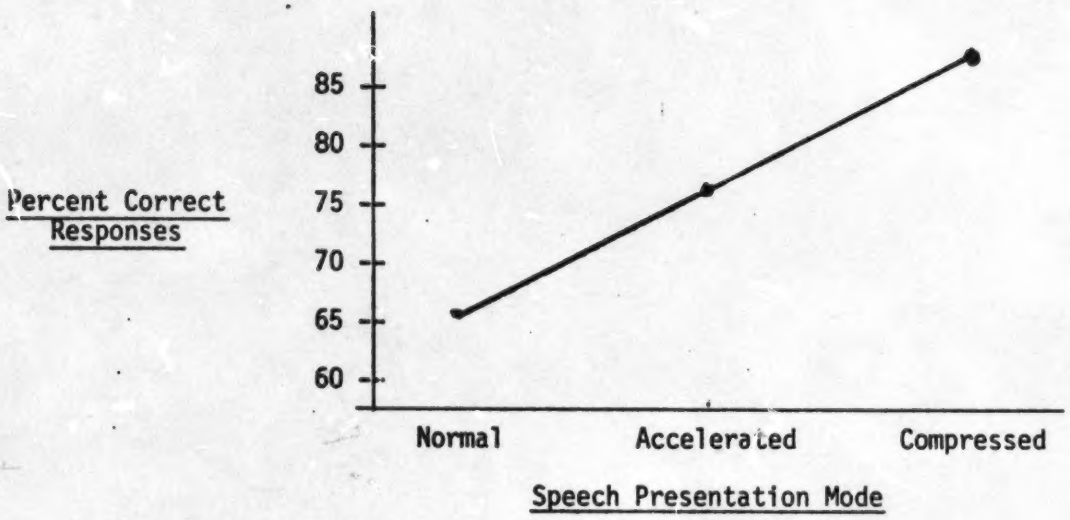

Figure 1 - Percent correct responses for all subjects (n = 13) as a function of mode of taped speech presentation.

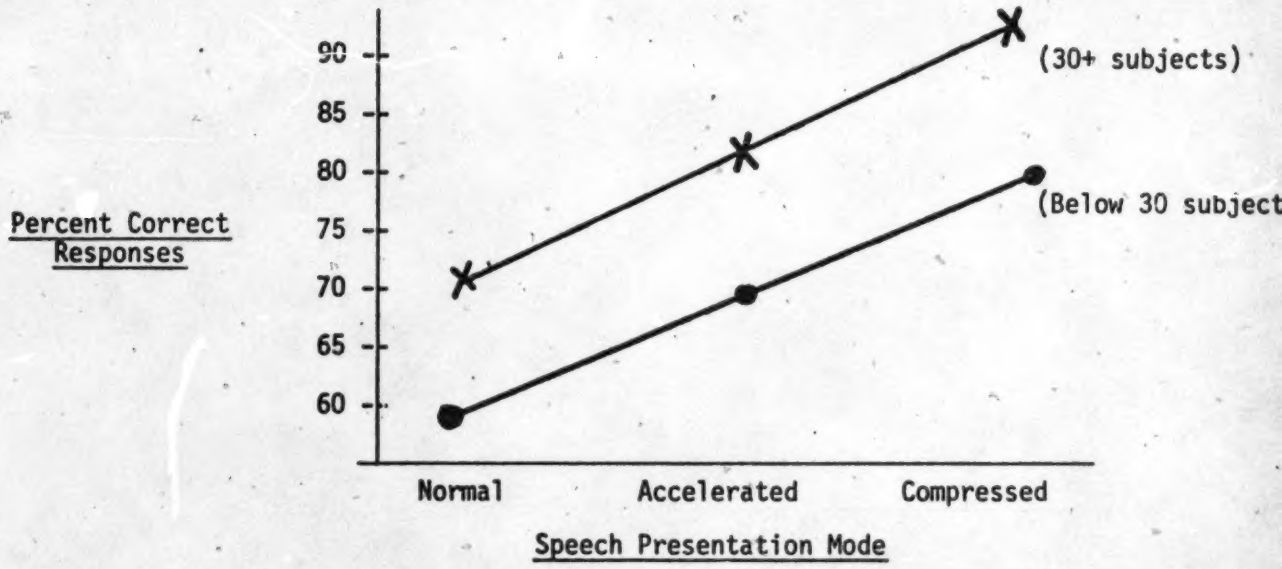

Figure 2 - Percent correct responses for the subjects 30 years and older vs. subjects below 30 years of age as a function of mode of speech presentation.